

This listing of claims will replace all prior versions, and listings, of claims in the application:

Claim 1 (canceled)

1 Claim 2 (currently amended): The method of claim ~~[[1]]~~
2 18 further comprising:
3 ~~[[4]]~~ maintaining, using the first node, a first
4 timer for tracking a send time interval, wherein the
5 ~~[[acts]]~~ act of ~~[[composing the aggregated message~~
6 ~~and]]~~ sending the aggregated message ~~[[are]]~~ is
7 performed after expiration of the first timer; and
8 ~~[[e]]~~ restarting, using the first node, the first
9 timer after the aggregated message is sent.

1 Claim 3 (previously presented): The computer-implemented
2 method of claim 2 wherein the aggregated message further
3 includes a dead time interval, and wherein the send time
4 interval is less than the dead time interval.

1 Claim 4 (previously presented): The computer-implemented
2 method of claim 2 wherein the aggregated message further
3 includes a dead time interval, and wherein the send time
4 interval is no more than one third of the dead time
5 interval.

1 Claim 5 (previously presented): The computer-implemented
2 method of claim 2 wherein the send time interval is less
3 than one second.

1 Claim 6 (previously presented): The computer-implemented
2 method of claim 2 wherein the send time interval is less
3 than 100 msec.

1 Claim 7 (currently amended): The computer-implemented
2 method of claim ~~[[1]]~~ 18 wherein the aggregated message
3 further includes a dead time interval.

1 Claim 8 (currently amended): The computer-implemented
2 method of claim ~~[[1]]~~ 18 wherein the act of sending the
3 aggregated message includes providing the aggregated
4 message in an Internet protocol packet.

1 Claim 9 (currently amended): The computer-implemented
2 method of claim 8 wherein the aggregated message is sent
3 ~~[[towards the neighbor node]]~~ by setting a destination
4 address in the Internet protocol packet to a multicast
5 address associated with routers that support aggregated
6 interface forwarding liveness.

Claim 10 (canceled)

1 Claim 11 (currently amended): For use with a node, a
2 computer-implemented method comprising:
3 a) receiving, using the node, an aggregated message
4 including, ~~[[1]]~~ for a first set of at least two
5 different interfaces of a neighbor node, at least
6 two indicators, each indicator identifying a
7 different one of the at least two different
8 interfaces of ~~[[a]]~~ the neighbor node and
9 corresponding forwarding liveness status information
10 for each of the at least two different interfaces of

11 the first set of the at least two different
12 interfaces as data within the aggregated message[
13 and
14 ~~ii) a time interval]]~~; and
15 b) updating, using the node, neighbor node
16 forwarding liveness status information using the
17 aggregated message,
18 wherein the forwarding liveness status
19 information includes an integrity and correct
20 operation of a forwarding table of the neighbor
21 node, and
22 wherein the act of updating neighbor node
23 forwarding liveness status information includes
24 i) determining, by the node, whether the first
25 set of at least two different interfaces is the
26 same as a second set of at least two different
27 interfaces of the neighbor node included in an
28 earlier message,
29 ii) if the first set of at least two different
30 interfaces is determined to be the same as the
31 second set of at least two different
32 interfaces, then for each of the at least two
33 different interfaces of both the first and
34 second sets having a changed status, informing,
35 by the node, a local interface of the changed
36 status of its peer interface of the neighbor
37 node, and
38 iii) if the first set of at least two
39 different interfaces is determined to be
40 different from the second set of at least two
41 different interfaces, then

42 A) for any interface in the first set but
43 not in the second set, informing, by the
44 node, a local interface of the status
45 indicated in the aggregated message of its
46 peer interface of the neighbor node, and
47 B) for any interface in the second set
48 but not in the first set, informing, by
49 the node, a local interface that the
50 status of its peer interface of the
51 neighbor node is down.

1 Claim 12 (currently amended): The computer-implemented
2 method of claim 11 wherein the aggregated message further
3 includes a time interval and wherein the act of updating
4 neighbor node liveness status information further
5 includes

6 [[i+]] = setting a first timer to the time
7 interval and starting the first timer,
8 [[i+]] = if the first timer expires, setting a
9 status of each of the at least two different
10 interfaces of the neighbor node to down; and
11 [[i+i]] = if a further message, sourced from
12 the neighbor node, and including

13 A) for a third set of at least two
14 different interfaces, at least two
15 indicators, each indicator identifying a
16 different one of the at least two
17 different interfaces of the neighbor node
18 and corresponding forwarding liveness
19 status information for each of the
20 interfaces of the third set, and
21 B) a new time interval,

22 is received then, resetting the first timer to
23 the new time interval and restarting the first
24 timer.

1 Claim 13 (previously presented): The
2 computer-implemented method of claim 12 wherein each of
3 the time interval and the new time interval is less than
4 one second.

1 Claim 14 (previously presented): The
2 computer-implemented method of claim 11 wherein the
3 forwarding liveness status information is interface
4 forwarding liveness status information.

1 Claim 15 (previously presented): The
2 computer-implemented method of claim 11 wherein the
3 status information includes a forwarding liveness state
4 selected from a group of forwarding liveness states
5 consisting of (A) interface up, (B) interface down, (C)
6 interface monitor not reporting, and (D) forwarding
7 engine restarting.

1 Claim 16 (previously presented): The
2 computer-implemented method of claim 11 wherein the
3 forwarding liveness status information further includes
4 at least one of (i) the integrity and correct operation
5 of switch fabric, (ii) the integrity and correct
6 operation of a forwarding lookup engine, (iii) the
7 integrity and correct operation of a traffic scheduler,
8 (iv) the integrity and correct operation of a traffic
9 classifier, (v) the integrity and correct operation of
10 buffers in the data plane, (vi) the integrity and correct

11 operation of packet segmentation modules, (vii) the
12 integrity and correct operation of packet reassembly
13 modules, (viii) the integrity and correct operation of
14 packet re-sequencing modules, (ix) whether or not a node
15 is restarting, (x) whether or not the forwarding plane is
16 congested, or (xi) the integrity and correct operation of
17 fragmentation modules.

1 Claim 17 (currently amended): The computer-implemented
2 method of claim 11 wherein the forwarding liveness status
3 information further includes at least one of (i) bit
4 error rate at a link interface, and (ii) clock
5 synchronization at a link interface.

1 Claim 18 (currently amended): A computer-implemented
2 method for monitoring interface forwarding liveness, the
3 method comprising:
4 a) determining, at a first node, forwarding
5 liveness status information for a first set of at
6 least two different interfaces of the first node;
7 b) sending, from the first node, an aggregated
8 message including, for the first set of at least two
9 different interfaces, at least two indicators, each
10 indicator identifying a different one of at least
11 two different interfaces and the corresponding
12 determined status information for the at least two
13 different interfaces as data within the aggregated
14 message;
15 c) receiving, at the second node, the aggregated
16 message; and

17 d) updating, by the second node, first node
18 forwarding liveness status information using the
19 aggregated message,
20 wherein the forwarding liveness status
21 information includes an integrity and correct
22 operation of a forwarding table of the first node,
23 and
24 wherein the act of updating first node
25 forwarding liveness status information includes
26 i) determining, by the second node, whether
27 the first set of at least two different
28 interfaces of the first node is the same as a
29 second set of at least two different interfaces
30 of the first node included in an earlier
31 message,
32 ii) if the first set of at least two different
33 interfaces is determined to be the same as the
34 second set of at least two different
35 interfaces, then for each of the at least two
36 different interfaces of both the first and
37 second sets having a changed status, informing,
38 by the second node, a local interface of the
39 changed status of its peer interface of the
40 first node, and
41 iii) if the first set of at least two
42 different interfaces is determined to be
43 different from the second set of at least two
44 different interfaces, then
45 A) for any interface in the first set but
46 not in the second set, informing, by the
47 second node, a local interface of the
48 status indicated in the aggregated message

49 of its peer interface of the first node,
50 and
51 B) for any interface in the second set
52 but not in the first set, informing, by
53 the second node, a local interface that
54 the status of its peer interface of the
55 first node is down.

1 Claim 19 (currently amended): The computer-implemented
2 method of claim 18 wherein the aggregated message further
3 includes a dead interval, and wherein the act of updating
4 first node forwarding liveness status information further
5 includes
6 [[~~i~~]] = setting a timer to the dead interval;
7 [[~~ii~~]] = starting the timer;
8 [[~~iii~~]] = determining whether or not a further
9 message including forwarding liveness status
10 information is received from the first node
11 before the expiration of the timer; and
12 [[~~iv~~]] = if it is determined that a further
13 message including forwarding liveness status
14 information is not received from the first node
15 by the second node before the expiration of the
16 timer, then informing the second node that the
17 at least two different interfaces of the first
18 node are down.

1 Claim 20 (previously presented): The
2 computer-implemented method of claim 18 wherein the
3 status information includes a forwarding liveness state
4 selected from a group of forwarding liveness states
5 consisting of (A) interface up, (B) interface down, (C)

6 interface monitor not reporting, and (D) forwarding
7 engine restarting.

1 Claim 21 (previously presented): The
2 computer-implemented method of claim 18 wherein the
3 forwarding liveness status information further includes
4 at least one of (i) the integrity and correct operation
5 of switch fabric, (ii) the integrity and correct
6 operation of a forwarding lookup engine, (iii) the
7 integrity and correct operation of a traffic scheduler,
8 (iv) the integrity and correct operation of a traffic
9 classifier, (v) the integrity and correct operation of
10 buffers in the data plane, (vi) the integrity and correct
11 operation of packet segmentation modules, (vii) the
12 integrity and correct operation of packet reassembly
13 modules, (viii) the integrity and correct operation of
14 packet re-sequencing modules, (ix) whether or not a node
15 is restarting, (x) whether or not the forwarding plane is
16 congested, or (xi) the integrity and correct operation of
17 fragmentation modules.

1 Claim 22 (previously presented): The
2 computer-implemented method of claim 18 wherein the
3 forwarding liveness status information includes at least
4 one of (i) bit error rate at a link interface, and (ii)
5 clock synchronization at a link interface.

Claims 23-29 (canceled)

1 Claim 30 (currently amended): The apparatus of claim
2 ~~[[29]]~~ 46 further comprising:

3 ~~[[iv+]]~~ - maintaining a first timer for
4 tracking a send time interval, wherein the act
5 of ~~[[composing the aggregated message and]]~~
6 sending the aggregated message composes
7 ~~[[compose]]~~ and sends ~~[[send]]~~ the aggregated
8 message after expiration of the first timer;
9 and
10 ~~[[v+]]~~ - restarting the first timer after the
11 aggregated message is sent.

1 Claim 31 (previously presented): The apparatus of claim
2 30 wherein the aggregated message further includes a dead
3 time interval, and wherein the send time interval is less
4 than the dead time interval.

1 Claim 32 (previously presented): The apparatus of claim
2 30 wherein the aggregated message further includes a dead
3 time interval, and wherein the send time interval is no
4 more than one third of the dead time interval.

1 Claim 33 (previously presented): The apparatus of claim
2 30 wherein the send time interval is less than one
3 second.

1 Claim 34 (previously presented): The apparatus of claim
2 30 wherein the send time interval is less than 100 msec.

1 Claim 35 (currently amended): The apparatus of claim
2 ~~[[29]]~~ 46 wherein the aggregated message further includes
3 a dead time interval.

1 Claim 36 (currently amended): The apparatus of claim
2 ~~[[29]]~~ 46 wherein the act of sending the aggregated
3 message includes providing the aggregated message in an
4 Internet protocol packet.

1 Claim 37 (previously presented): The apparatus of claim
2 36 wherein the act of sending the aggregated message
3 includes setting a destination address in the Internet
4 protocol packet to a multicast address associated with
5 routers that support interface forwarding liveness.

Claim 38 (canceled)

1 Claim 39 (currently amended): ~~[[For use with a node,~~
2 ~~apparatus]]~~ Apparatus comprising:
3 a) one or more processors;
4 b) at least one input device; and
5 c) one or more storage devices storing
6 processor-executable instructions which, when
7 executed by one or more processors, perform a method
8 of:
9 i) receiving an aggregated message including,
10 ~~[[A]]~~ for a first set of at least two different
11 interfaces of a neighbor node, at least two
12 indicators, each indicator identifying a different
13 one of the at least two different interfaces of
14 ~~[[a]]~~ the neighbor node and corresponding forwarding
15 liveness status information for the at least two
16 different interfaces of the first set of the at
17 least two different interfaces as data within the
18 aggregated message~~[[, and~~
19 ~~[[B]] a time interval]]~~; and

20 ii) updating neighbor node forwarding liveness
21 status information using the aggregated message,
22 wherein the forwarding liveness status information
23 includes an integrity and correct operation of a
24 forwarding table of the neighbor node, and
25 wherein the act of updating neighbor node
26 forwarding liveness status information includes
27 A) determining, by the node, whether the
28 first set of at least two different
29 interfaces is the same as a second set of
30 at least two different interfaces of the
31 neighbor node included in an earlier
32 message,
33 B) if the first set of at least two
34 different interfaces is determined to be
35 the same as the second set of at least two
36 different interfaces, then for each of the
37 at least two different interfaces of both
38 the first and second sets having a changed
39 status, informing, by the node, a local
40 interface of the changed status of its
41 peer interface of the neighbor node, and
42 C) if the first set of at least two
43 different interfaces is determined to be
44 different from the second set of at least
45 two different interfaces, then
46 1) for any interface in the first
47 set but not in the second set,
48 informing, by the node, a local
49 interface of the status indicated in
50 the aggregated message of its peer
51 interface of the neighbor node, and

52 2) for any interface in the second
53 set but not in the first set,
54 informing, by the node, a local
55 interface that the status of its peer
56 interface of the neighbor node is
57 down.

1 Claim 40 (currently amended): The apparatus of claim 39
2 wherein the aggregated message further includes a time
3 interval and wherein the act of updating neighbor node
4 liveness status information further includes
5 [[A+]] - setting a first timer to the time
6 interval and starting the first timer,
7 [[B+]] - setting a status of each of the
8 at least two different interfaces of the
9 neighbor node to down if the first timer
10 expires; and
11 [[C+]] - if a further message, sourced
12 from the neighbor node, and including
13 1) for a third set of at least two
14 different interfaces, at least two
15 indicators, each indicator
16 identifying a different one of the at
17 least two different interfaces of the
18 neighbor node and corresponding
19 forwarding liveness status
20 information for each of the
21 interfaces of the third set, and
22 2) a new time interval,
23 is received, resetting the first timer to
24 the new time interval and restarting the
25 first timer.

1 Claim 41 (previously presented): The apparatus of claim
2 39 wherein each of the time interval and the new time
3 interval is less than one second.

1 Claim 42 (previously presented): The apparatus of claim
2 39 wherein the forwarding liveness status information is
3 interface forwarding liveness status information.

1 Claim 43 (previously presented): The apparatus of claim
2 39 wherein the status information includes a forwarding
3 liveness state selected from a group of forwarding
4 liveness states consisting of (A) interface up, (B)
5 interface down, (C) interface monitor not reporting, and
6 (D) forwarding engine restarting.

1 Claim 44 (previously presented): The apparatus of claim
2 39 wherein the forwarding liveness status information
3 further includes at least one of (i) the integrity and
4 correct operation of switch fabric, (ii) the integrity
5 and correct operation of a forwarding lookup engine,
6 (iii) the integrity and correct operation of a traffic
7 scheduler, (iv) the integrity and correct operation of a
8 traffic classifier, (v) the integrity and correct
9 operation of buffers in the data plane, (vi) the
10 integrity and correct operation of packet segmentation
11 modules, (vii) the integrity and correct operation of
12 packet reassembly modules, (viii) the integrity and
13 correct operation of packet re-sequencing modules, (ix)
14 whether or not a node is restarting, (x) whether or not
15 the forwarding plane is congested, or (xi) the integrity
16 and correct operation of fragmentation modules.

1 Claim 45 (currently amended): The apparatus of claim 39
2 wherein the forwarding liveness status information
3 further includes at least one of (i) bit error rate at a
4 link interface, and (ii) clock synchronization at a link
5 interface.

1 Claim 46 (currently amended): A system comprising:
2 a) a first node including
3 i) one or more processors;
4 ii) at least one input device; and
5 iii) one or more storage devices storing
6 processor-executable instructions which, when
7 executed by one or more processors, perform a
8 method of:
9 A) determining, at ~~[[a]]~~ the first node,
10 forwarding liveness status information for
11 a first set of at least two different
12 interfaces of the first node, and
13 B) sending, from the first node, an
14 aggregated message including, for the
15 first set of at least two different
16 interfaces, at least two indicators, each
17 indicator identifying a different one of
18 at least two different interfaces and the
19 corresponding determined status
20 information for the at least two different
21 interfaces as data within the aggregated
22 message,
23 wherein the forwarding liveness
24 status information includes an integrity
25 and correct operation of a forwarding
26 table of the first node; and

27 b). a second node including
28 i) one or more processors;
29 ii) at least one input device; and
30 iii) one or more storage devices storing
31 processor-executable instructions which, when
32 executed by one or more processors, perform a
33 method of:
34 A) receiving, at the second node, the
35 aggregated message sent by the first node,
36 and
37 B) updating first node forwarding
38 liveness status information using the
39 aggregated message,
40 wherein the act of updating first
41 node forwarding liveness status
42 information includes
43 1) determining, by the second node,
44 whether the first set of at least two
45 different interfaces is the same as a
46 second set of at least two different
47 interfaces of the first node included
48 in an earlier message,
49 2) if the first set of at least two
50 different interfaces is determined to
51 be the same as the second set of at
52 least two different interfaces, then
53 for each of the at least two
54 different interfaces of both the
55 first and second sets having a
56 changed status, informing, by the
57 second node, a local interface of the

58 changed status of its peer interface
59 of the first node, and
60 3) if the first set of at least two
61 different interfaces is determined to
62 be different from the second set of
63 at least two different interfaces,
64 then
65 (a) for any interface in the
66 first set but not in the second
67 set, informing, by the second
68 node, a local interface of the
69 status indicated in the
70 aggregated message of its peer
71 interface of the first node, and
72 (b) for any interface in the
73 second set but not in the first
74 set, informing, by the second
75 node, a local interface that the
76 status of its peer interface of
77 the first node is down.

1 Claim 47 (currently amended): The system of claim 46
2 wherein the aggregated message further includes a dead
3 interval, and wherein the act of updating first node
4 forwarding liveness status information further includes
5 [[i+]] - setting a timer to the dead interval;
6 [[ii+]] - starting the timer;
7 [[iii+]] - determining whether or not a further
8 message including forwarding liveness status
9 information is received from the first node
10 before the expiration of the timer; and

11 ~~[[iii]]~~ - informing the second node that the
12 at least two different interfaces of the first
13 node are down if it is determined that a
14 further message including forwarding liveness
15 status information is not received from the
16 first node by the second node before the
17 expiration of the timer.

1 Claim 48 (previously presented): The system of claim 46
2 wherein the status information includes a forwarding
3 liveness state selected from a group of forwarding
4 liveness states consisting of (A) interface up, (B)
5 interface down, (C) interface monitor not reporting, and
6 (D) forwarding engine restarting.

1 Claim 49 (previously presented): The system of claim 46
2 wherein the forwarding liveness status information
3 further includes at least one of (i) the integrity and
4 correct operation of switch fabric, (ii) the integrity
5 and correct operation of a forwarding lookup engine,
6 (iii) the integrity and correct operation of a traffic
7 scheduler, (iv) the integrity and correct operation of a
8 traffic classifier, (v) the integrity and correct
9 operation of buffers in the data plane, (vi) the
10 integrity and correct operation of packet segmentation
11 modules, (vii) the integrity and correct operation of
12 packet reassembly modules, (viii) the integrity and
13 correct operation of packet re-sequencing modules, (ix)
14 whether or not a node is restarting, (x) whether or not
15 the forwarding plane is congested, or (xi) the integrity
16 and correct operation of fragmentation modules.

1 Claim 50 (original): The system of claim 46 wherein the
2 forwarding liveness status information includes at least
3 one of (i) bit error rate at a link interface, and (ii)
4 clock synchronization at a link interface.

1 Claim 51 (currently amended): The computer-implemented
2 method of claim ~~[[1]]~~ 18 wherein the forwarding liveness
3 status information of at least one of the at least two
4 different interfaces included in the aggregated message
5 includes a forwarding liveness state set to interface
6 monitor not reporting.

1 Claim 52 (currently amended): The computer-implemented
2 method of claim ~~[[1]]~~ 18 wherein the forwarding liveness
3 status information of at least one of the at least two
4 different interfaces included in the aggregated message
5 includes a forwarding liveness state set to forwarding
6 engine restarting.

1 Claim 53 (previously presented): The
2 computer-implemented method of claim 11 wherein the
3 forwarding liveness status information of at least one of
4 the at least two different interfaces included in the
5 first set of at least two different interfaces included
6 within the aggregated message includes a forwarding
7 liveness state set to interface monitor not reporting.

1 Claim 54 (previously presented): The
2 computer-implemented method of claim 11 wherein the
3 forwarding liveness status information of at least one of
4 the at least two different interfaces included in the
5 first set of at least two different interfaces included

- 6 within the aggregated message includes a forwarding
- 7 liveness state set to forwarding engine restarting.